SITE INVESTIGATION, SAMPLING, AND WASTE MANAGEMENT PLAN

Mortandad Canyon Multiple Permeable Reactive Barrier Project

May 15, 2001

IT Corporation
335 Central Park Square
Los Alamos, NM 87544-2358

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS/ACRONYMS

ASTM	American Society of Testing Materials
ºC	degrees Celsius
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration Project
ESH-19	Hazardous and Solid Waste Group
ft	foot/feet
in.	inch(es)
IT	IT Corporation
LANL	Los Alamos National Laboratory
LLW	low-level waste
mg/kg	milligrams per kilogram
MLLW	mixed low-level waste
MSSL	medium-specific screening levels
nCi/g	nanocuries per gram
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOI	Notice of Intent
PPE	personal protective equipment
PRB	permeable reactive barrier
PRS	potential release site
PVC	polyvinyl chloride

LIST OF ABBREVIATIONS/ACRONYMS (Continued)

QA	quality assurance
QC	quality control
SOP	Standard Operating Procedure
SPT	Standard Penetration Tests
SVOC	semi-volatile organic compound
TCLP	toxicity characteristic leaching procedure
TSD	treatment, storage, disposal facility
UTR	University of California Technical Representative
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	Waste Characterization Strategy Form
WMC	waste management coordinator

1.0 SITE INVESTIGATION

IT Corporation (IT) will conduct a site investigation to assess the proposed location for the installation of a multiple permeable reactive barrier (PRB) (i.e., multi-barrier) within Mortandad Canyon. The objective of the investigation is to determine parameters necessary for the design of the barrier and provide site-specific waste characterization information. Parameters to be determined from the investigation include:

- Contaminant concentrations (soil and groundwater)
- Aquifer thickness and lateral extent
- Depth to bedrock
- Hydraulic conductivity and porosity of soils adjacent to the barrier
- Visual classification of soils and lithologic units
- Grain size distribution of soils adjacent to the barrier
- In-situ moisture content of soils
- Standard Penetration Tests to evaluate soil stability during construction
- Depth to groundwater
- Soil/bentonite mixtures required for slurry wall construction.

Characterization of the volume and type of waste material to be excavated, managed, and disposed is required for completion of the Title I phase of this project. The information provided will be used to project costs related to proper disposal of said wastes. Accurate projections of anticipated waste types and volumes are required to proceed to the Title II phase of the project. In addition, water samples will be needed for radiochemical, perchlorate, and nitrate characterization.

IT conducted a review of existing data for Mortandad Canyon to determine anticipated contaminant concentrations for soil and water, hydrogeologic conditions, lithology, and geotechnical parameters. This information is referenced within the Site-Specific Health and Safety Plan and was used to select appropriate personal protective equipment (PPE) for the field investigation.

1.1 Drilling Location(s)

The proposed multi-barrier will be located in Mortandad Canyon at Los Alamos National Laboratory (LANL). Based on a review of hydrogeologic information and a site walk, the site to be investigated will be located near existing wells MCO-4A and MCO-4B. Eight borings/characterization wells will be drilled for site characterization. Six of these borings will be located along the potential PRB alignment in the canyon. Two additional borings will be placed in the center of the stream channel and will be used to evaluate the saturation and hydraulic conductivity of the weathered tuff up to 10 feet (ft) below the alluvium. One well will be screened at 5 ft and the other at 10 ft (Figure 1-1) below the alluvium/tuff interface. All of the borings exhibiting groundwater

PRB Plan
Rev. 0.0
May 15, 2001

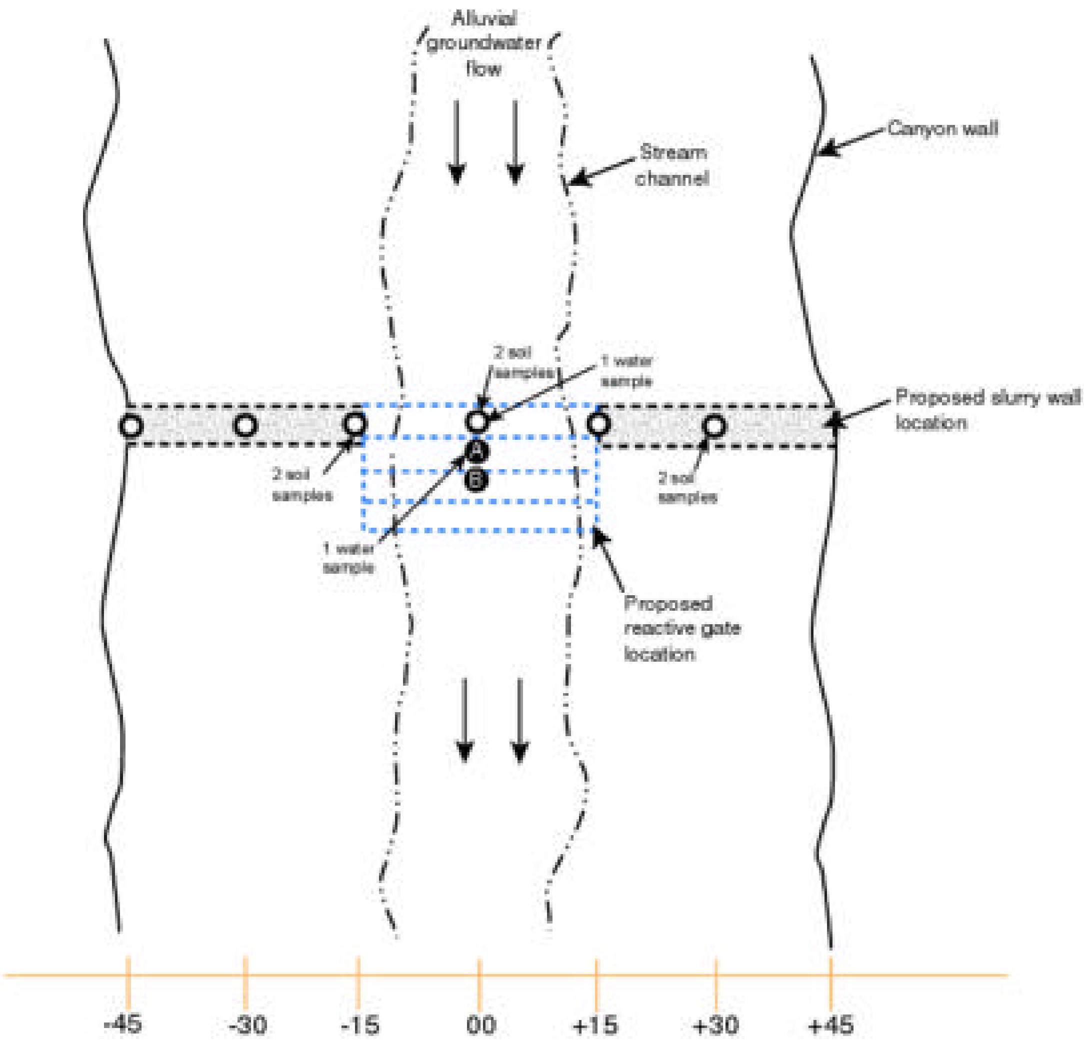

Figure 1-1. Proposed Soil Boring/Characterization Well Locations for Geotechnical and Hydrologic Investigation in Mortandad Canyon

2

will be completed as temporary characterization wells and slug tested to determine in-situ hydraulic conductivity. All of the wells will be removed after completion of the slug testing. The polyvinyl chloride (PVC) pipe will be removed and the wells will be backfilled with bentonite pellets. Permanent monitoring wells will be installed following installation of the PRB and used for long term performance monitoring. Figure 1-1 shows the proposed location of the boreholes for site investigation.

1.2 Drilling and Characterization Well Installation

1.2.1 Drilling and Soil Sampling Procedures

The drilling subcontractor will drill 8 soil borings/characterization wells. Six of the wells will be installed within the alluvium to a depth of approximately 30 ft. Two of the soil borings/characterization wells located in the center of the stream channel will be drilled 5 ft and 10 ft below the alluvium/tuff interface (Figure 1-1). The boreholes will be advanced by using the hollow-stem auger drilling technique and 4-inch (in.) inside-diameter augers. Drill cuttings will be containerized in 55-gallon steel drums or in a lined roll-off box and later analyzed to determine appropriate disposal alternatives (see Section 3.0 Waste Management). Split spoon soil samples and Standard Penetration Tests (SPT) in accordance with American Society of Testing Materials (ASTM) D 1586, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils" (ASTM, 1999) will be obtained continuously in order to evaluate the geotechnical properties of the soils. SPT blow counts will be obtained using a 140-pound hydraulic or pneumatic hammer.

The bedrock (tuff) surface is located approximately 30 ft below the ground surface. The subsurface layers, blow count, and any field observations will be indicated in the drilling logs (completed by IT). In addition to the split-spoon sampling, a continuous core may be collected for each borehole within the saturated zone using a 5-ft long continuous sampler. This will enable samples to be collected from undisturbed deposits and will provide penetration data (i.e., blow counts) to be recorded for each sampling interval.

An IT field geologist will examine and visually classify the soil samples according to ASTM D 2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" (ASTM, 1993). After examination and classification of all soil samples, the geologist will select one representative sample from each subsurface layer, and send the samples to a designated geotechnical laboratory for classification and all necessary testing.

Upon retrieving each split-spoon sampler, the sample will be removed and inspected. The principal component of the sample will be identified and described first, followed by other components in decreasing order of occurrence. For each component, a general grain size (e.g., silt, sand, and gravel) will be given, followed by the approximate proportion of the sample that it comprises (e.g., 60 to 70%), any appropriate modifier (e.g., coarse), a description of the color, and the degree of angularity. After all components of the sample have been described in this manner, information regarding the overall sample properties will be recorded, such as degree of sorting, relative water content (e.g., dry, moist), odor, and any unusual color or staining.

Descriptions of formation samples will be recorded on a Visual Classification of Soils Log. Other information that will be recorded on the form includes the following:

- Project number and location,
- Date, including start and stop dates if drilling at a particular location extends to a period of more than one day,
- Name of field geologist,
- Names of drilling contractor and driller,
- Drilling method and equipment,
- Sampling interval,
- Borehole depth and diameter,
- Land surface elevation,
- Blow counts required for each 6 inches of split-spoon advancement,
- Sample recovery,
- Well construction details, and
- Groundwater elevation.

After completion of the soil borings, a 2-in. PVC well casing and screen will be installed in each borehole, sand packed and provided with a bentonite seal. The casing will consist of a capped 2-ft riser threaded to a PVC well screen (0.010-in. slot) threaded to a PVC riser to approximately 2 ft above grade. The screen for the alluvium wells will be placed from 2 ft above bedrock to approximately 5-ft below ground surface. The screen for the wells completed in bedrock will be 5 ft long placed 5 ft and 10 ft below the alluvium/tuff interface. The site geologist will complete the Borehole/Well Construction Field Data Log following well completion.

A filter pack consisting of clean quartz sand will be installed around the screen, extending to a level approximately 3-ft above the top of the screen. The sand to be used as the filter pack will be a Global #5 sand (or equivalent) which is recommended for 0.010 to 0.020-in. slot screens. The filter pack will be installed through the annular space between the well assembly and the augers, as the augers are slowly pulled from the borehole. Wells will then be partially developed per Section 1.2.2.

Following partial well development, bentonite pellets will be poured in from the top of the annulus between the well casing and augers at a slow rate to prevent bridging. If the natural formation along the sides of the borehole is unstable and prone to collapsing into the annulus, the auger string will be left in the hole during bentonite seal placement to the extent practical. The auger string will be gradually removed as the level of bentonite pellets rises. For shallow wells, where the top of the filter pack is above the water table and relatively close to ground surface, a bentonite pellet seal will be installed by gradually pouring bentonite pellets from the top of the annulus. Intermittent sounding (using a weighted tape measure) of the top of solid annular materials will be conducted to accurately document well construction.

Decontamination of downhole equipment and materials including, but not limited to, drill pipe, rods, bits, and samplers will be performed. All drilling equipment will be cleaned with a hot-water pressure washer prior to drilling each boring and prior to leaving the site. All sampling equipment will be decontaminated with an Alconox wash/deionized water rinse prior to the collection of each soil sample. A plastic lined sump will be constructed in the vicinity of the site to function as a decontamination pad. A transfer pump will be used to transfer decontamination water to a 55-gallon drum or to a 3,000-gallon polyethylene tank.

1.2.2 Well Development Procedure

All newly installed wells will be developed to remove fine-textured sediments that may enter the well during installation. Well development will be in accordance with LANL Environmental Restoration (ER)-Standard Operating Procedure-(SOP) 5.02, "Well Development" (LANL, 1999a). Because the wells will be completed in a perched alluvial aquifer, the wells will be partially developed before the bentonite seal is added.

Well development will be accomplished by pumping with a surface or submersible pump, aided by surge-block development technique. To ensure proper well development, the pump intake will be initially set at the bottom of the well and then moved to the top of the well screen as development proceeds. To ensure that the well will be free of sediment during sampling, the well will be pumped at variable rates during development. To maximize efficiency of this method, a surge block development technique may be used. A surge block will be lowered or pushed down the borehole, forcing fluids into the formation. The upstroke motion will create a suction that will pull the loose sediments from the formation into the well. The well will be then purged, as often as possible between surging, to remove the loose sediments.

The adequacy of development will be based primarily on the sediment content of the water removed from the well. Wells will be developed until five times the standing water volume is removed and they yield sediment free water, to the extent practical. Water removed from wells during development will be stored in 55-gallon drums or tanks pending analysis (see Section 3.0).

1.2.3 Decontamination of Drilling Equipment

Prior to beginning drilling activities at each well location the drilling equipment (e.g., augers, drilling rods, split spoons) will be taken to a designated location and pressure washed, or, if necessary, steam cleaned. Before the drilling rig leaves the work area at the end of the site investigation, the drilling rig will also be decontaminated. Pressure washing and steam cleaning are capable of removing even tar-like substances from metal surfaces, and do not introduce cleaning agents (e.g., organic solvents) to the sampling equipment, which could cause contamination of samples that is not related to site conditions. A decontamination pad will be constructed for this purpose. Water produced during decontamination will be collected and containerized pending analysis (see Section 3.0).

Submersible pumps will be decontaminated by pumping a Liquinox and potable water solution through the pump and hose, and washing the outside of the pump and hose with this same solution. Potable water will then be pumped through the pump and hose as a rinse, and rinsed over the outside of the pump and hose.

Transducers will be decontaminated by washing with a Liquinox and potable water solution and rinsing with potable water, followed by a final rinse with deionized water.

Disposable equipment such as gloves, booties, visqueen, and liquids will be containerized and labeled.

1.3 Field Permeability Test

All characterization wells established in the saturated zone will be slug tested according to ER-SOP-7.03, “Well Slug Tests” (LANL, 1992a). The wells will be outfitted with pressure transducers connected to a data logger. Measurements will be taken from each well to determine the in-situ hydraulic conductivity of the soils.

Calibration and use of the pressure transducers will be performed in accordance with ER-SOP-7.01, “Pressure Transducers” (LANL, 1992b).

The static water level in the well will be measured in accordance with ER-SOP-7.02, “Fluid Level Measurement” (LANL, 1992c). Information will be recorded on the Groundwater Evaluation form. The pressure transducer will be installed in the designated test well and calibrated. In addition, pressure transducers will be installed in the other wells in the particular well nest.

A previously prepared slug of known volume will be tied to a suitable hauling line and lowered into the well to a point just above the water level. The slug test data form should provide an accurate listing of slug dimensions.

The data logger will be activated and allowed to run for about 1 second. While the data logger is functioning, the slug will be lowered rapidly, but smoothly, into the well, just below the initially recorded water level.

The slug will be secured in this position, and testing will proceed until the well has reached equilibrium.

The data logger will be used, intermittently, to read and document the water-level data. The on-site hydrologist/hydrogeologist will examine the data to determine whether or not equilibrium has been attained. Equilibrium is defined as four consecutive readings that are “equal,” within the permissible variance value associated with the selected pressure transducer.

The slug hauling line will be untied from its surface attachment, and the data logger will be activated for a period of 1 second.

The slug will be lifted above the water surface smoothly and quickly (but not removed from the well) and secured to the well casing. The recovery test will then be performed as previously described.

The data acquired from performance of slug tests will be evaluated using standard analytical procedures based on the hydrogeologic setting (unconfined or semi-confined aquifer). Estimates of hydraulic conductivity will be obtained for the selected test locations corresponding to the perched aquifer. The test performance data, analytical evaluation procedures, and the parameter estimates will be provided in the field summary report.

2.0 SAMPLING AND ANALYSIS

This section provides a detailed description of the sampling activities planned for the Mortandad Canyon PRB multi-barrier project. Sampling activities will occur in two phases:

- Phase I: Sampling to determine site-specific waste characterization information and design parameters for the PRB prior to construction.

- Phase II: Confirmatory sampling to determine final waste characterization information prior to disposal following installation of the PRB.

2.1 Sampling Strategy/Approach

The sampling strategy for the Mortandad Canyon PRB project is designed to ensure that sufficient data is obtained to determine

- site-specific waste characterization data information for estimating waste types, quantities, and disposal costs,
- design parameters for the PRB, and
- final waste characterization data for the water and excavated soils prior to disposal.

Sufficient sample volumes will be collected for all intended analyses, including Toxicity Characteristic Leachate Procedure (TCLP) metals, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and radiochemistry. Sampling personnel will collect samples in accordance with all applicable LANL ER SOPs. The samples will be shipped offsite to Severn Trent Laboratories, Inc for analysis. All data will be of sufficient quality to adequately characterize the hazardous and radiological contaminates at the site.

2.2 Sample Collection

2.2.1 Soil Samples

A total of 6 waste characterization soil samples will be collected from the boreholes/characterization wells installed during the geotechnical investigation. Two samples each from three of the boreholes located along the potential PRB alignment will be collected . Samples will be collected from the upper saturated/unsaturated interface and the alluvium/tuff interface. Geotechnical soil samples will be collected from each of the boreholes. A representative sample from each subsurface layer will be sent to a designated geotechnical laboratory. The samples will be collected using a split spoon sampler in accordance with ER-SOP-6.24, "Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers" (LANL, 2001). All waste characterization soil samples will be shipped to the offsite laboratory and analyzed for the constituents identified in Section 2.3.

Final waste characterization sampling will take place after the PRB is constructed. These samples will generally consist of one composite soil sample from each of the roll-off containers filled with soil/sediment during construction. The samples will be used to verify the waste characterization data obtained from the borehole samples and will be compared to the waste acceptance criteria (WAC) for the treatment, storage, and disposal (TSD) facility to which the waste will be shipped.

2.2.2 Water Samples

A total of 2 groundwater samples and one well development/decontamination water sample will be collected. The groundwater samples will be collected in accordance with ER-SOP-6.01, "Purging of Wells for Representative Sampling of Groundwater" (LANL, 1999b). These samples will remain unfiltered for analysis.

2.3 Analytical Parameters

All waste characterization samples will be collected and containerized in accordance with ER-SOP-1.02, "Sample Container and Preservation" (LANL, 1992d) and "Test Methods for Evaluating Solid Waste; Physical/Chemical Methods," *SW-846* (U.S. Environmental Protection Agency [EPA], 1986). Table 2-1 provides the analytical parameters specific to the water samples collected for site characterization.

Table 2-1
Parameters, Sample Volumes/Containers, Preservation Techniques, Holding Times, and Methods for Water Samples

Parameter	Sample Volume	Sample Container [a]	Preservative [b]	Holding Time (days)	Method [c]
Metals and Ions					
TCLP [d] Metals Arsenic Barium Cadmium Chromium Lead Selenium Silver	500 ml	G, PTFE lined cap	4 °C, ice	180 days for TCLP extraction and analysis	1311 extraction, 6010/7000 for analysis
TCLP Mercury	500 ml	G, PTFE lined cap	4 °C, ice	28 days for TCLP extraction and analysis	1311 extraction, 7471 analysis
NO3 – N	1000 ml	P, G	H_2SO_4 [e], pH <2, 4 °C, ice	14 days	Ion Chromatography, EPA Method 300
Perchlorates	20 ML	P, G	4 °C, ice	NA	Ion Chromatography

Table 2-1 (continued)
Parameters, Sample Volumes/Containers, Preservation Techniques, Holding Times, and Methods for Water Samples

Parameter	Sample Volume	Sample Container [a]	Preservative [b]	Holding Time (days)	Method [c]
Organic					
VOC	120 ml	G, PTFE lined cap	4 °C, ice	14 days	1311 extraction, 8260 analysis
SVOC	1000 ml	AG, PTFE lined cap	4 °C, ice	14 days	1311 extraction, 8270 analysis
Radiological					
Cesium-137	1000 ml	P, G	HNO_3 [f], pH <2	180 days	Gamma spectroscopy
Americium-241	1000 ml	P, G	HNO_3, pH <2	180 days	Alpha spectrometry
Isotopic Plutonium (Pu-238, 239/240)	1000 ml	P,G	HNO_3, pH <2	180 days	Alpha spectrometry
Strontium-90	1000 ml	P	HNO_3, pH <2	180 days	Gas proportional counting
Tritium	1000 ml	P, G	HNO_3, pH <2	180 days	Liquid scintillation counting

[a] Polyethylene (P), Glass (G), Amber Glass (AG), PTFE (Teflon)
[b] Sample preservation will be performed immediately upon sample collection.
[c] Except where noted, the methods listed are from EPA, 1996, Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846.
[d] TCLP = toxicity characteristic leaching procedure
[e] H_2SO_4 = sulfuric acid
[f] HNO_3 = nitric acid

Table 2-2 provides specific analytical parameters for the soil/sediment samples collected for site and waste characterization. These tables also present appropriate sample volumes/ containers, preservation techniques, holding times, and methods for analysis for all of the analytical parameters.

Table 2-2
Parameters, Sample Volumes/Containers, Preservation Techniques, Holding Times, and Methods for Soil/Sediment Samples

Parameter	Sample Volume	Sample Container [a]	Preservative [b]	Holding Time (days)	Method [c]
Metals					
TCLP [d] Metals Arsenic Barium Cadmium Chromium Lead Selenium Silver	120 g	G, PTFE lined cap	4 °C, ice	180 days	1311 extraction, 6010/7000 for analysis
TCLP Mercury	10 g	G, PTFE lined cap	4 °C, ice	28 days for TCLP extraction and analysis	1311 extraction, 7471 analysis

Table 2-2 (continued)
Parameters, Sample Volumes/Containers, Preservation Techniques, Holding Times, and Methods for Soil/Sediment Samples

Parameter	Sample Volume	Sample Container [a]	Preservative [b]	Holding Time (days)	Method [c]
Organics					
VOC	120 g	G, PTFE lined cap	4 °C, ice	7 days for extraction and analysis	1311 extraction, 8260 analysis
SVOC	120 g	AG, PTFE lined cap	4 °C, ice	7 days until extraction; 40 days after extraction	1311 extraction, 8270 analysis
Radiological					
Cesium-137	500 g	P, G	None	180 days	Gamma spectroscopy
Americium-241	10 g	P,G	None	180 days	Alpha spectrometry
Isotopic Plutonium (Pu-238, 239/240)	10 g	P,G	None	180 days	Alpha spectrometry
Strontium-90	10 g	P	None	180 days	Gas proportional counting
Tritium	10 g	P, G	None	180 days	Liquid scintillation counting

[a] Polyethylene (P), Glass (G), Amber Glass (AG), PTFE (Teflon)
[b] Sample preservation will be performed immediately upon sample collection.
[c] Except where noted, the methods listed are from EPA, 1996, Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846.
[d] TCLP = toxicity characteristic leaching procedure

Appropriate chemical preservatives (e.g., acids) will be added to sample bottles by the analytical laboratory prior to sample collection. Samples that require cooling to 4 degrees Celsius (°C) will be placed in a cooler with ice or ice gel or in a refrigerator immediately upon collection.

2.4 Quality Assurance and Quality Control

The analytical laboratory will run matrix spike and laboratory control samples as required by *SW-846* (EPA, 1986). No trip blanks or duplicate samples are planned for analysis. All samples will be analyzed following EPA *SW-846* methodologies, as appropriate. A complete quality assurance/quality control (QA/QC) data package that will meet the ER Project required “Level IV” or equivalent criteria will be included as a deliverable from the laboratory.

Copies of the sampling paperwork and the Chain of Custody forms will be provided to the University of California Technical Representative (UTR). The Laboratory will be notified if the samples require dilution for chemical analysis.

2.5 Sample Packaging and Shipping

Sample packaging and shipping will be performed in accordance with ER-SOP-1.03 “Handling, Packaging and Shipping of Samples” (LANL, 2000a). The transportation of all samples for the Mortandad Canyon PRB project will be processed through the Business Operations Division Materials Management Group, shipping office. The exterior of all transport packages will be screened for radiological surface contamination by a radiological control technician prior to transport to the analytical laboratory. This screening will determine the packaging requirements as defined by the U.S. Department of Transportation (DOT) regulations. DOT Type A packaging requirements will be used for sample packages with radiation screening levels below 100 nanocuries per gram (nCi/g). DOT type B packaging requirements will be used for sample packages with radiation screening levels above 100 nCi/g. Samples that require cooling to 4 °C will be transported in a cooler with ice or ice gel.

3.0 WASTE MANAGEMENT

Wastes generated during the Mortandad Canyon PRB project will be managed and characterized in accordance with the following LANL ER SOPs:

- ER-SOP-1.06, "Management of ER Project Waste" (LANL, 1996a)
- ER-SOP-1.10, "Waste Characterization" (LANL, 1996b)
- ER-SOP-1.11, "Radioactive Waste Management for ER Project Field Operations" (LANL, 1997a)

The Mortandad Canyon PRB project may generate hazardous waste, low-level waste (LLW), mixed low level waste (MLLW), and non-hazardous solid and liquid wastes. The disposal paths for each of the waste types will be determined based on the characterization of the waste materials as described in Section 3.1. The waste management coordinator (WMC) will serve as the point of contact for all field activities. The WMC will complete the Waste Characterization Strategy Form to ensure that a characterization strategy is in place for all wastes before they are generated.

3.1 Waste Characterization

Waste characterization will be based on analytical results and will ensure: 1) that wastes are handled in compliance with all applicable regulations; and 2) that the WAC for the applicable TSD is met. Waste characterization activities for the wastes generated by the Mortandad Canyon PRB project will occur in two phases:

- Phase I: Sampling to determine site-specific waste characterization information and design parameters for the PRB prior to construction.

- Phase II: Confirmatory sampling to determine final waste characterization information prior to disposal following installation of the PRB.

The phase I sampling data will serve as the primary waste characterization information for estimating waste types, quantities, and disposal costs. In addition, this information will be used for the determination of appropriate waste management practices and final design parameters for the PRB. A total of eight boreholes/characterization wells will be drilled at the site under consideration for the emplacement of the PRB. Six soil samples will be collected and analyzed for radionuclides, TCLP metals, VOCs, and SVOCs. Two groundwater samples will also be collected and analyzed for radionuclides, nitrate, and perchlorate. Additionally, a water sample will be collected from water generated as a result of well development and decontamination activities and analyzed for VOCs and SVOCs. These water samples will serve as the characterization data for all wastewater generated during the project, as appropriate.

The phase II sampling data will be conducted following the installation of the PRB and will verify that the soil/sediment wastes meet the WAC of the disposal facility to which they will be shipped. Confirmatory sampling will generally consist of one composite sample collected from each of the roll-off containers to verify the waste characterization obtained during phase I. The samples will be shipped to an off-site laboratory where they will be analyzed for radionuclides, TCLP metals, volatile organic compounds, and semi-volatile organic compounds.

3.1.1 Hazardous Waste

All soils/sediments, water, decontamination fluids, PPE, and equipment that are or may be contaminated with qualifying hazardous constituents will be managed to comply with applicable hazardous waste regulations. This will include the establishment of < 90 storage area for the storage of wastes pending final analytical data for waste characterization. The < 90 day storage area will be registered with Hazardous and Solid Waste Group (ESH-19) and will be inspected weekly for container deterioration, leaks, and spills. All containers in the < 90 storage area will be labeled with a “HAZARDOUS WASTE” label that includes all known or suspected hazardous constituents until final waste characterization information is obtained.

3.1.2 Characteristic Waste

It is not anticipated that the wastes generated during the site characterization or construction of the Mortandad Canyon PRB will be classified as characteristic hazardous waste.

3.1.3 Listed

Routine maintenance activities at Potential Release Site (PRS) 00-001 (Mortandad Sediment Traps) in July 2000, generated wastes with low levels of toluene, acetone, tetrachloroethene, benzene, methyl ethyl ketone, methylene chloride, o-xylene, m-xylene, and 1, 2, dichloroethene (cis). LANL proposed a “no-longer-contained-in” determination to New Mexico Environment Department (NMED) using the EPA Region 6 Human Health Medium-Specific Screening Levels (MSSL) for the contaminants at the site. NMED approved the request for a “no-longer-contained-in” determination and the excavated soils/sediments were managed as non-hazardous solid waste. The contaminants identified at PRS 00-001 are believed to have originated upstream from the proposed location of the Mortandad Canyon PRB and therefore, have the potential to be present at the PRB location.

Upon completion of site characterization, the data will be compared to the MSSLs for the above mentioned F-listed wastes and any others as they are encountered. A request similar to the one mentioned above will be sent to NMED if these constituents are present. If the concentrations of any constituents in the excavated material or water are equal to or exceed the MSSLs, the material will be managed as listed hazardous waste. If they are below the MSSLs, the material will be managed appropriately as low-level or solid waste unless and until it meets another listing criteria or exhibits a hazardous characteristic.

3.1.4 Low Level and Mixed Low Level Waste

The waste materials from the Mortandad Canyon PRB project are anticipated to contain radioactive constituents at levels that will require the waste to be classified as LLW or MLLW depending on the hazardous constituents. These wastes will be stored in a secure area to prevent inadvertent or accidental intrusion and exposures. Radioactive liquid wastewater will be contained in 55-gallon drums at the site and transported off-site for treatment. Radioactive solid wastes will be assessed by a radiation control technician to determine the radionuclide concentration level based on ER-SOP-10.07, “Field Monitoring for Surface and Volume Radioactivity Levels” (LANL, 1997b) and guidance in ER-SOP-01.03 (LANL, 2000a).

The waste will be stored in roll-off containers or 55-gallon drums that meet DOT requirements for waste transportation. All containers holding known or suspected LLW or MLLW will be marked “CAUTION, RADIOACTIVE WASTE” pending final characterization data. The label will also include the description and origin of the waste, the container contact, 1-meter exposure rates in millirem per hour, and the name of the waste generator. MLLW will also be labeled as indicated in Section 3.1.1.

3.2 Waste Types and Volumes

Wastes to be generated during installation of the Mortandad Canyon PRB will include soil cuttings, wastewater from the installation of new characterization wells, excavated soil and sediment, PPE and decontamination liquids. Table 3-1 provides a list of the potential waste types and volumes that will be generated over the course of the project.

Table 3-1
Potential Waste Types and Volumes for the Mortandad Canyon Permeable Reactive Barrier Project

Item	Potential Waste Types	Anticipated Volume
Drill cuttings	LLW, MLLW	4 cubic yards (yd^3)
Excavated soil/sediment	LLW, MLLW	500 yd^3
Wastewater	LLW, MLLW	2,500 gallons
Personal protective equipment	LLW, Non-Hazardous/Non-Radioactive Waste	< 1 yd^3
Decontamination Liquids	LLW	300 gallons

The following sections provide a detailed description of the waste types and potential levels of contamination.

3.2.1 Drill Cuttings

Eight soil borings/characterization wells will be drilled into the alluvium in Mortandad Canyon. Drill cuttings will be containerized in 55-gallon steel drums or in a single waste container such as a B-25 box or lined roll-off pending final waste characterization.

3.2.2 Excavated Soil/Sediment

Excavated soil/sediment waste will be generated during the installation of the PRB. These soils/sediments will be stored in 20 cubic yard roll-off bins (containers) pending final waste characterization. Table 3-2 presents historical data regarding the contamination levels of the soil/sediment in Mortandad Canyon.

Table 3-2
Existing Sediment and Soil Data for Mortandad Canyon

Parameter	Sediment [a]	Soil [b]
RADIONUCLIDES (pCi/g)		
Americium-241	NO DATA	NO DATA
Plutonium-238	3.2 – 31.3	0.007 – 0.117
Plutonium-239/240	8.1 – 78.3	0.006 – 0.095
Strontium-90	NO DATA	NO DATA
Alpha	9.2 – 23.3	3.6 - 6.0
Beta	7.6- 17.1	3.0 - 3.9
INORGANICS[d] (mg/kg)		
Arsenic	< 0.3	NO DATA
Barium	14.7 – 15.6	NO DATA
Cadmium	< 0.2	NO DATA
Chromium	2.1 – 3.7	NO DATA
Lead	5.5 – 7.2	NO DATA
Mercury	0.009	NO DATA
Selenium	< 0.4	NO DATA
Silver	< 0.4	NO DATA
ORGANICS (mg/kg)		
Toluene	0.027 [c]	NO DATA
Acetone	0.038 [c]	NO DATA
Tetrachlorethene	0.008 [c]	NO DATA
Benzene	0.001 [c]	NO DATA
Methyl ethyl ketone	0.014 [c]	NO DATA
Methylene chloride	0.003 [c]	NO DATA
o-xylene	0.002 [c]	NO DATA
m-xylene	0.005 [c]	NO DATA
1,2-dichloroethene (cis)	0.003 [c]	NO DATA

a. Unless otherwise noted, data from LANL, 1999, "Environmental Surveillance at Los Alamos During 1999, " Chapter 5.0, Los Alamos National Laboratory, Los Alamos, New Mexico reported for sampling near well MCO-5.
b. Data from soil borings at well MCM-5.1, 4 to 27 feet, Stoker et. al., 1991, "Extent of Saturation in Mortandad Canyon, "Los Alamos National Laboratory, Los Alamos, New Mexico, p. 66.
c. Organic data for sediments from letter dated July 7, 2000, From: Julie Canepa (ER Program Manager), To: Mr. John Kieling (NMED-HRMB), Subject: Request for "No Longer Contained In" Determination for Potential Release Site (PRS) 00.001, Mortandad Sediment Traps.
d. Total Recoverable Trace Metals.

These data indicate that the waste may contain F-listed organic constituents and will require that the waste be stored as mixed low-level waste in a <90 day storage area pending final waste characterization. Upon receipt of waste characterization analytical data, soil determined to be solid waste (not hazardous or radiologically contaminated) may potentially be used for backfill. Those wastes determined to be low level waste only will be transported to an appropriate TSD facility or mixed with bentonite to form the slurry walls as described in Section 4.1.

3.2.3 Wastewater

Wastewater will be generated during the installation of the characterization wells and construction of the PRB. All wastewater will be containerized in 55-gallon drums or 3,000-gallon polyethylene tanks, and characterized based on the initial waste characterization data generated prior to construction. Table 3-3 provides historical data regarding the contamination levels of the groundwater in Mortandad Canyon. The wastewater will be discharged or transported to an appropriate wastewater treatment facility as determined by comparison of the characterization data to the New Mexico Water Quality Control Commission (NMWQCC) groundwater limits or the selected facility's WAC. A notice of intent (NOI) to discharge benign groundwater on-site will be prepared and submitted by LANL's water Quality and Hydrology Group for NMED approval.

Table 3-3
Existing Groundwater Contaminant Data for Mortandad Canyon

Parameter	Groundwater	
	Well MCO-4B [a]	Well MCO-5 [b]
RADIONUCLIDES (pCi/L)[c]		
Americium-241	0.48 – 1.03	0.17 [d] - 0.485 [e]
Plutonium-238	0.003 – 0.01	0.019 [e] – 0.16
Plutonium-239/240	0.01 – 0.05	0.031 – 0.65 [d]
Strontium-90	38.3 – 140	32.2[d] – 32.3
Gross Alpha	5.8 – 25.7	5.2 - 7.6 [e]
Gross Beta	131 – 625.8	131.0 [e] – 184.0
INORGANICS (ug/L)[c]		
Arsenic	< 2.0	< 2.0
Barium	85.2 – 150	80.0 [f] – 160.0
Cadmium	2.0 – 7.0	< 3.0
Chromium	7.0 – 10.0	0.01 [f]
Lead	1.0 – 3.0	< 60.0
Mercury	0.2	< 0.1
NO3-N[g]	16.20 – 36.6 mg/L	32.9
Selenium	< 3.0	< 3.0
Silver	10.0 – 14.0	< 6.0

Parameter	Groundwater	
	Well MCO-4B [a]	Well MCO-5 [b]
ORGANICS (ug/L)[c]		
Toluene	< 5.0	ND
Acetone	86.0	ND
Tetrachlorethene	NO DATA	NO DATA
Benzene	< 5.0	NO DATA
Methyl ethyl ketone	NO DATA	NO DATA
Methylene chloride	< 5.0	NO DATA
o-xylene	< 5.0	NO DATA
m-xylene	< 5.0	NO DATA
1,2-dichloroethene (cis)	< 5.0	NO DATA

a. Environmental Surveillance Report Data, 1996 through 1998.
b. Unless otherwise noted, data from LANL, 1999, "Environmental Surveillance at Los Alamos During 1999, " Chapter 5.0, Los Alamos National Laboratory, Los Alamos, New Mexico.
c. All samples were unfiltered unless otherwise specified.
d. Data from American Radiation Services, Inc., ARS-01-0244, Radiological Data Package for Samples from MCO-5, 2001.
e. LANL, 1997, "Environmental Surveillance at Los Alamos During 1997, " Chapter 5.0, Los Alamos National Laboratory, Los Alamos, New Mexico.
f. Assaigai Analytical Laboratories, 01DS055, Metal Data for samples from MCO-5, 2001.
g. Filtered sample, mg/L.

3.2.4 Other Waste

Miscellaneous wastes will be minimized and will primarily consist of contaminated PPE, equipment, and decontamination liquids generated over the course of the project. These wastes will be packaged into 55-gallon drums and transported to an appropriate TSD upon completion of final waste characterization.

3.3 Method of Management and Disposal

All wastes generated during the site characterization and construction of the Mortandad Canyon PRB will be stored as hazardous LLW pending final waste characterization. Once fully characterized the wastes will be transported off-site to an appropriate TSD facility depending on the waste type.

3.3.1 Waste Staging and Documentation

All hazardous wastes will be staged and handled in accordance with the New Mexico Administrative Code, Title 20, Chapter 4, Part 1, Subpart III, Part 262, "Standards Applicable to Generators of Hazardous Waste." A <90 day storage area will be established based on the initial characterization data for the storage of any known or suspected hazardous or mixed wastes generated during the project.

Field personnel that are trained in waste management will affix and maintain all required postings, labels, and signs. Waste forms will be completed and submitted in a timely manner such that hazardous wastes will be shipped before expiration of the < 90 day hazardous waste storage limit. The inspections of the storage area will be conducted according to guidance criteria established by ESH-19. All wastes that 1) are appropriate and approved for the particular wastes types, 2) meet transportation requirements, and 3) meet the WAC of the receiving TSD facility, will be staged in closed containers awaiting transportation.

3.4 Waste Transportation and Disposal

Selection of disposal facilities for excavated wastes will be limited to those that are pre-approved by LANL. Wastes will be disposed of only at facilities where the waste meets the WAC and the appropriate state regulations governing the TSD.

3.4.1 Liquid Waste

Liquid wastes generated during the Mortandad Canyon PRB will be containerized into 55-gallon drums for characterization. This waste will either be discharged on-site after approval of an NOI or shipped to the TA-50 Radioactive Liquid Waste Treatment Facility or the Sanitary Wastewater Systems for treatment depending on the initial waste characterization information and these facility WACs.

3.4.2 Solid Waste

Solid waste generated during the Mortandad Canyon PRB will be containerized into 55-gallon drums standard waste boxes, or roll-off containers for shipment to an appropriate TSD facility depending on the final waste characterization. Table 3-4 provides a list of acceptable TSD facilities for the solid waste types anticipated by the PRB project. The final waste characterization data for each container will be evaluated against each TSDs WAC to determine the appropriate facility for disposal.

Table 3-4
Proposed Treatment, Storage, and Disposal Facilities for Each Waste Type

Waste Type	Proposed Treatment, Storage, and Disposal Facilities
Hazardous	Waste Control Specialists (WCS)[1] TA-54, Solid Waste Operations (SWO)
MLLW	Envirocare WCS[1, 2]
LLW	TA-54, SWO
Non-Hazardous/ Non-Radioactive	Rio Rancho Industrial Solid Waste Landfill

1 Will not accept high levels of mercury.
2 Cannot accept radioactive contamination unless an authorized limits release has been obtained.

4.0 DESIGN

Design of the PRB will be conducted in two phases, conceptual and final. The conceptual design including the hydrologic and geochemical modeling will be developed to the extent necessary to produce a set of design drawings and material specifications with enough detail to prepare a budgetary cost estimate for final design and installation of the PRB. Following approval of the conceptual design and associated cost estimate, final design drawings and material specifications will be prepared.

4.1 Design Approach

The PRB will be installed within the alluvium deposits in Mortandad Canyon. The groundwater, in general, flows in the same eastward direction as the surface water. The shallow aquifer bounded by the narrow canyon walls provides favorable site conditions to demonstrate the PRB as an in-situ treatment of groundwater.

The PRB will contain four media cells consisting of gravel, Apatite II, pecan shells, and limestone. As currently planned, the system will be a funnel and gate design consisting of a centralized reactive gate located to capture a majority if not all of the groundwater. The funnel will consist of low permeability soil-bentonite slurry walls extending from each side of the PRB (Figure 1-1). The reactive gate and slurry walls will extend from approximately two to three feet below ground surface to the bedrock. A funnel and gate configuration is anticipated based on the following considerations:

- Reducing the width (perpendicular to groundwater flow) of the reactive gate can provide benefits by reducing the volume of excavated material requiring disposal and the quantity of reactive materials emplaced.

- The funnel walls will provide hydraulic containment of the groundwater during seasonal fluctuations and direct the flow of groundwater through the reactive gate.

- Based on previous investigations within Mortandad Canyon, it is anticipated that the alluvial groundwater flow is located primarily beneath the stream channel and therefore the width of the reactive gate should encompass this flow.

Soils/sediments excavated from the site during construction may potentially be combined with bentonite to form the funnel walls (slurry walls) and reduce waste disposal costs. Slurry walls will require approximately a 4% bentonite to soil mixture, which will be verified during construction.

4.1.1 Site Selection

A review of existing data for Mortandad Canyon was conducted in order to select a single site for PRB installation. Analytical, geotechnical, and hydrologic results were reviewed and evaluated. Primary evaluation factors that were considered include:

- The depth of excavation,
- The velocity and volume of groundwater flow,
- The amount of waste which must be managed and disposed,
- Impacts to the canyon (i.e, tree removal, road establishment, existing hydrology, stream channel impacts),
- Existing characterization well locations.

4.1.2 Hydraulic Modeling

Hydraulic modeling will be performed to determine the optimum location, orientation, configuration, and dimensions of the PRB. Data collected during the site investigation will be used to develop the conceptual site model. Hydraulic modeling will be conducted to evaluate:

- A suitable location and configuration of the PRB in the Mortandad Canyon with respect to the groundwater flow, contaminant movement and the canyon walls.
- An optimum orientation of the PRB to capture the maximum flow with the minimum volume of reactive material.
- Optimum dimensions of low permeability (funnel) and permeable-reactive (gate) portions of the system.
- The expected groundwater flow velocity through the cell.
- The hydraulic capture zone of the PRB and potential changes to the flow field that could result in a portion of the flow bypassing the reactive material.
- Monitoring point placement within the PRB and the surrounding aquifer.
- Hydraulic conductivity requirements for the reactive medium and associated media particle sizes.

4.1.3 Geochemical Evaluation of PRB

A geochemical evaluation is important to ensure the effectiveness and longevity of the barrier. A barrier might fail if the media is used up (e.g., if sorption sites become completely occupied) and allows for breakthrough or if precipitates form and eventually clog the media. Geochemical evaluation is used to assess the interactions between the reactive medium, constituents of concern, and constituents that are naturally in the groundwater.

Precipitation of solid phases within the PRB will be evaluated by LANL using porewater chemistry and known mineralogy of the PRB. These data and information can be used as input parameters for geochemical modeling using the computer programs PHREEQC2. and MINTEQA2. Mineral precipitation is feasible provided that the porewater becomes saturated with respect to solids. These solids may consist of metal-oxyhydroxides (iron and manganese), silicate, phosphate, and carbonate phases. Provided that the effective porosity is sufficient, additional precipitation of solid phases should not hinder groundwater flow through the PRB.

4.1.4 Design Criteria

Design criteria as presently understood, that will guide the design of the multibarrier include:

- Residence time = minimum of 0.25 days per layer

- Lifetime of barrier = 10 years
- Safety factor for PRB reactive media volume = 1.5
- Following construction, the stream channel must be maintained in its current location,
- Surface infiltration and erosion must be minimized through the use of impermeable barriers and riprap/boulders,
- Monitoring: Two monitoring wells, one upstream and one downstream, will be available to monitor influent groundwater chemistry and barrier treatment performance. Additionally, monitoring wells will be installed within the individual barrier materials to provide layer specific performance data.
- The PRB will be configured to optimize hydraulic capture of the plume with a limited volume of reactive material.

Table 4-1 presents the contaminants to be absorbed and the residence times for each individual layer as currently understood. The absorptive capacities for each of the materials is still to be determined with the exception of the Apatite II, which has an adsorptive capacity of 42 milligrams per kilogram (mg/kg) for strontium and 92 mg/kg for uranium. The adsorptive capacity for uranium may be used to estimate a conservative value for plutonium and americium.

Table 4-1
Design Criteria for Barrier Materials

Design Criteria for Barrier Materials		
Material	**Contaminant**	**Residence Time(days)**
Gravel	Colloids	0.25
Apatite II	Pu, Am, Sr	0.25
Pecan Shells	Nitrate, Perchlorate	0.25
Limestone Gravel	Anionic Species	0.25

Because hydrologic and geotechnical testing will be performed at a number of locations at the proposed site, the correction and safety factors incorporated into the design to account for uncertainties or heterogeneities may be reduced. Safety factors may be further reduced through modeling of PRB performance over a range of hydrologic and waste characterization input parameters rather than basing the design on average values alone.

4.1.5 Performance Criteria

The objective of this project is to demonstrate a multi-barrier PRB technology and not to achieve specific treatment criteria. However, treatment goals are specified in order to guide the design of the PRB. Input concentrations of contaminants used for design of the PRB will be determined during the site investigation. Treatment goals that the PRB will be designed to meet are based on the most stringent criteria of NMWQCC groundwater limits, U.S. Department of Energy (DOE) Derived Concentration Guides (DCGs) for drinking water systems, and EPA Primary Drinking Water Standards. The following table (Table 4-2) provides a summary of the treatment goals for effluent from the PRB.

Table 4-2
Treatment Goals for the Permeable Reactive Barrier

Parameter	Treatment Goal
Americium-241	1.2 pCi/L[a]
Nitrate – Nitrogen	10.0 mg/L[b]
Perchlorate	18 µg/L[c]
Plutonium – 238	1.6 pCi/L[a]
Plutonium – 239,240	1.2 pCi/L[a]
Strontium – 90	8 pCi/L[d]

[a] U.S. Department of Energy Drinking Water System Derived Concentration Guide
[b] New Mexico Water Quality Control Commission groundwater limit
[c] Action level proposed by State of California.
[d] U.S. Environmental Protection Agency Primary Drinking Water Standard

5.0 QUALITY ASSURANCE PLAN

5.1 LANL Technical Team QA Requirements

Implementation of the QA Plan will be the responsibility of everyone working on the project. The Subcontractor will play a critical role in ensuring QA for the design and installation phases of the project.

All work will be performed in accordance with approved LANL procedures, or Subcontractor procedures that have been approved by the LANL UTR prior to the start of any work. A copy of the Subcontractor's corporate written Quality Assurance Program will be obtained and placed on file.

This project will use external analytical laboratories for sample analysis. The external analytical laboratory must also have a documented quality assurance, or quality control, program that is in compliance with the DOE QA requirements. A copy of this plan will be secured and filed by the Technical Team.

5.2 Subcontractor QA Requirements

Among IT and subcontractor project staff, QA is the responsibility of each individual, with the Project Manager ultimately responsible for assuring implementation of QA standards and controls. The Project Manager will be the single point of responsibility to ensure the project team works together with the QA Manager.

The IT QA Program is documented in the IT Quality Assurance Manual and in various standard quality control implementation plans and procedures. In addition, the LANL ER QA Program will be followed throughout the project. The QA Manual, QA implementation documents, and the ER Quality Procedures will be used by IT personnel and team subcontractors to determine their quality responsibilities. Each project participant is responsible for performing work in a manner consistent with the requirements of these procedures. If anyone has a question on the process or interpretation of QA requirements, it will be incumbent upon the individual to ask a knowledgeable staff member, manager, or quality assurance representative for clarification.

At a minimum, QA reviews will be formally incorporated in the project at two milestones: prior to delivery of the conceptual engineering design and prior to delivery of the final engineering design. Additional QA reviews and/or surveillance will be incorporated as needed during the project.

5.2.1 Organization/Responsibilities

Figure 5-1 presents the project organization chart, which defines project-specific responsibilities and lines of communication. Additionally, a summary of the roles and responsibilities and levels of authority for our key project personnel is provided in Table 5-1.

Overall day-to-day execution of the contract requirements is the responsibility of the Project Manager, Darren Meadows, P.E. He will be directly responsible to the LANL UTR, John Kaszuba for all aspects of project execution, including technical performance, management and direction of personnel and subcontractors, baseline cost and schedule control, QA/QC implementation, and health and safety functions. He will provide a single point of accountability to the UTR for all aspects of this project, maintain effective communication and working relationships between the IT and LANL, ensure compliance to LANL directives and procedures, and routinely perform self-assessments to ensure quality work.

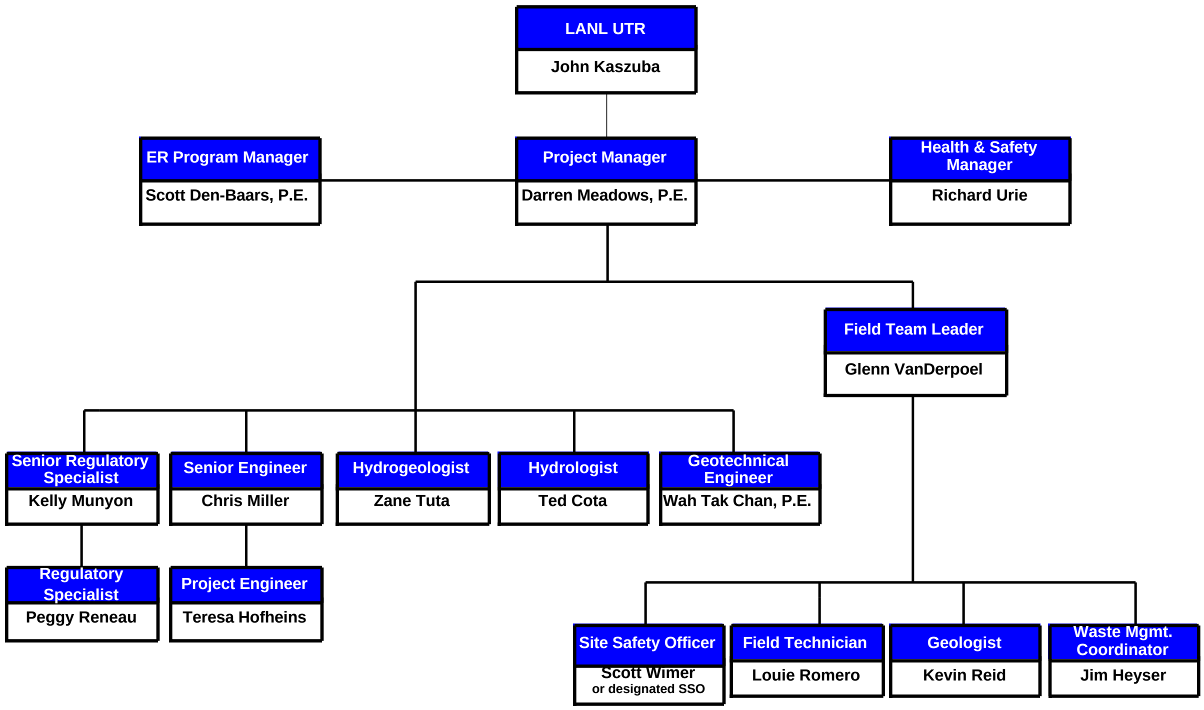

Figure 5-1. Organizational Chart

Table 5-1
Roles and Responsibilities and Levels of Authority for Key Project Personnel

Position	Responsibilities	Authorities
Project Manager	· Reports to Los Alamos National Laboratory (LANL) University of California Technical Representative (UTR) · Single point of responsibility to LANL for IT Corporation (IT) performance · Maintain effective communication and working relationships between IT and LANL to ensure client satisfaction · Deal promptly with contract-related problems · Ensure that LANL directives, orders, and standards are met · Assemble and manage proper mix of personnel · Meet monthly with LANL project representatives for cost/schedule/technical status · Perform self-assessments to ensure quality work · Conduct monthly audits to assess the effectiveness of safety programs and identify areas of improvement.	· Approve program policies and procedures · Accept work assignments · Make task order manager assignments · Negotiate and execute contract and task orders · Approve budget and expenditures · Effectively allocate resources · Implement management control systems, milestones, and schedules and reporting · Effectively manage subcontractors · Stop unsafe work
Field Team Leader (FTL)	· Reports to the project manager. · Ensures quality assurance/quality control procedures and inspections are implemented during field activities. · Ensures that field team personnel are qualified in accordance with applicable heath and safety (H&S) requirements. · Ensures that all H&S, sampling, decontamination, and disposal procedures are followed. · Ensures that all records including the Daily Activity Logs, Sample Collection Logs, Chain-of-Custody forms are completed. · Ensures that the site-specific health and safety plan (SSHASP) is developed.	· Provides technical guidance and direction as directed by the project manager. · Resolves H&S issues concerning field team members. · Directs fieldwork operations and field personnel. · Implements emergency response procedures. · Assigns tasks to field personnel as coordinated with project manager. · Stop unsafe work practices.
Site Safety Officer	· Verify that field personnel have the required certifications and training in accordance with the SSHASP. · Assist the FTL with implementation of the SSHASP. · Identify changes in site operations and conditions that warrant hazard mitigation and/or modifications to the SSHASP. · Coordinate with the FTL to ensure that field personnel are informed of any site conditions that pose a danger. · Ensure that copies of the SSHASP and any	· Develop the SSHASP. · Assess the necessity and arrange for monitoring of employee exposures to H&S hazards. · Perform and document inspections of site operations as required by the SSHASP and IT policies and procedures. · Stop unsafe work practices. · Assign a member of the field team to be the safety observer

Table 5-1
Roles and Responsibilities and Levels of Authority for Key Project Personnel

Position	Responsibilities	Authorities
	modification forms are current and readily accessible on-site. · Implement the safety observer program. · Implement the Safety Awareness, Recognition, and Participation Program for all field activities. · Report all "near miss" incidents and identify lessons learned. · Maintain health and safety-related project records.	for field activities. · Implement corrective actions for "near misses" to eliminate the potential for future incidents.
Waste Management Coordinator	· Reports to the Project Manager · Complete and receive approval for the project Waste Characterization Strategy Form (WCSF) · Plan and implement field waste characterization, packaging and storage in accordance with the WCSF and LANL Implementing Requirements. · Complete draft Waste Profile Forms and Waste Disposal Requests for LANL approval. · Ensure that waste storage and labeling is maintained in a compliant status. · Ensure that personnel participating in waste management tasks are trained. · Coordinate shipment of wastes in compliance with DOT and LANL Implementing Requirements.	· Direct waste segregation, packaging, and storage activities. · Correct non-compliant waste management practices. · Negotiate changes to the WCSF with LANL personnel.

5.2.2 Training

Documented evidence of personnel training and training material content will be maintained and made available to the UTR. All personnel will attend additional required job-specific and site-specific training applicable to their job responsibilities. A matrix of project personnel names, titles and required training has been submitted to LANL. A completed matrix showing current training for all project personnel will be provided and approved by LANL before commencement of field activities.

5.2.3 Field Documentation

Each day during field activities, the Field Team Leader will maintain a Field Notebook in accordance with ER Quality Procedure 5.7, "Notebook Documentation for Environmental Restoration Technical Activities" (LANL, 2000b). The Field Notebook is used to document the overall progress of field activities and serves to augment information recorded on the other field logs and forms. A field notebook will also be maintained by the Site Safety Officer. Additionally, activity specific documentation will be prepared such as sample collection logs, drilling logs, slug testing records, and water level measurement logs.

5.2.4 Design and Control of Scientific Investigations and Engineered Processes

All processes will be performed to LANL-approved and controlled procedures and work plans except where excluded in writing by LANL. Examples of scientific/engineering processes include calculations; technical design; physical sampling, handling, shipping, and storage; waste management; experiments; tests; chemical, radiological, and biological analyses; environmental remediation and data analysis (e.g., software). All calculations, designs, etc., become the property of LANL.

5.2.5 Instructions, Procedures, and Drawings

All work will be performed to LANL-approved and controlled procedures except where excluded in writing by LANL. Any procedures prepared will be done in accordance with guidelines specified by the LANL UTR and submitted in hard copy and electronic media.

Documentation describing the process and products resulting from the process (e.g., data and technical reports) must be adequate for process reproduction (by independent peers). Peer reviews, as evidenced by the reviewer's authentication, will be implemented on all quality records before submittal to LANL to ensure adequate quality of the deliverables based on the scope of work.

5.2.6 Control of Purchased Items and Services

Items or services procured under this subcontract will be performed in accordance with the applicable LANL requirements.

5.2.7 Identification and Control of Items

Written material specifications will be prepared to ensure that only correct and accepted items are used or installed within the PRB. The specifications will be submitted to LANL for approval.

5.2.8 Inspection

Quality-affecting activities are subject to inspection by LANL.

5.2.9 Control of Measuring and Test Equipment

Activities in which personnel use measuring and test equipment will be controlled in accordance with the applicable LANL procedures. Such devices will be controlled, calibrated, and adjusted at predetermined levels approved by LANL. Documentation of the control of measuring and test equipment will be available to LANL for review and verification.

5.2.10 Handling, Storage, and Shipping

Activities requiring personnel to handle, store, package, ship, or receive items, which if damaged, lost, or deteriorated would be detrimental to the work performed or those activities requiring personnel to handle, store, package, or ship hazardous material will be controlled by applicable LANL procedures.

5.2.11 Control of Nonconforming Items

Project changes/nonconformances, including those changes initiated during field operations, are governed by control measures commensurate with those applied to the statement of work. Changes and deviations will be identified, documented, evaluated, and dispositioned as a technical change, a contractual change, or a nonconformance. The control of nonconforming items will apply to all activities that involve the handling of items, including samples, data, raw materials, hardware, and software.

5.2.12 Accessibility and Records

The Subcontractor's work place and working records will be accessible during normal working hours for verification or audit by LANL or their representatives, during the performance of this contract. Each quality record generated will become the property of LANL and will be turned over to LANL within 30 days of completion of the record except where excluded in writing by the LANL UTR.

5.2.13 Records Turnover

All project documents, correspondence, and electronic deliverables that have been executed, completed, approved and which furnish evidence of the quality and completeness of data (including raw data) and of activities affecting quality will be considered Quality Records and are the property of DOE and LANL. Quality Records include but are not limited to the following:

- As-built drawings
- Chain-of-custody forms
- Field and laboratory calibration records
- Field records
- Logbooks
- Survey reports
- Work plans
- Forms completed from Standard Operating Procedures
- Training and qualification records
- Health and Safety Plans
- Permit compliance reports
- Drawings
- Concurrence reports
- Maps
- Photographs
- Electronic Media
- Quality assurance addenda

The above-stated listing (as a minimum) will be treated as Quality Records and protected in one-hour fire rated or equivalent cabinets while in-process. Within 30 days of project completion, all of the original Quality Records will be delivered to the LANL UTR for authentication.

6.0 REFERENCES

ASTM, 1993, “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure),” ASTM D 2488, American Society of Testing Materials.

ASTM, 1999, “Standard Test Methods for Penetration Test & Split-Barrel Sampling of Soils,” ASTM D 1586, American Society of Testing Materials.

EPA, 1986 and all approved updates, “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,” *SW-846*, U.S. Environmental Protection Agency.

LANL, 1992a, “Well Slug Tests,” ER-SOP-7.03, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1992b, “Pressure Transducers,” ER-SOP-7.01, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1992c, “Fluid Level Measurement,” ER-SOP-7.02, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1992d, “Sample Container and Preservation,” ER-SOP-1.02, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1996a, “Management of ER Project Waste,” ER-SOP-1.06, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1996b, “Waste Characterization,” ER-SOP-1.10, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1997a, “Radioactive Waste Management of ER Project Field Operations, ER-SOP-1.11, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1997b, “Field Monitoring for Surface and Volume Radioactivity Levels,” ER-SOP-10.07, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1999a, “Well Development,” ER-SOP-5.02, Rev.1, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1999b, “Purging of Wells for Representative Sampling of Groundwater,” ER-SOP-6.01, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2000a, “Handling, Packaging, and Shipping of Samples,” ER-SOP-1.03, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2000b, "Notebook Documentation for Environmental Restoration Technical Activities," QP-5.7, Rev. 1.0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2001, "Sample Collection from Split-Spool Samplers and Shelby Tube Samplers," ER-SOP-6.24, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.